

THE TREATMENT OF FRACTURED PATELLA.¹

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THE lack of certainty in the results of treatment in cases of fracture of the patella, and the different values that are put by writers on the subject upon the various methods of securing the fulfilment of the general indications in the management of this injury, with a desire to learn what experience has taught the members of this society in the matter, are the reasons for submitting to the society this evening for discussion a short paper on the treatment of fracture of the patella, in order that the conclusions drawn from cases that have been under my care may be either confirmed or corrected.

That the discussion may be as practical as possible, and at the same time confined within reasonable limits, I submit the question: What is the best treatment in recent cases of simple transverse fracture of the patella? An answer to this question would doubtless be, in the main, the same by each of us, yet we should differ as to the relative importance of the obstacles to be overcome and the methods available for the purpose.

It is important to remember, in the first place, that the patella lies loosely in the tendon when the limb is lying in a horizontal position with the muscle relaxed, that the bone can be moved by passive motion freely and easily in a lateral and a downward direction, and not only so, but can be moved upward at will a distance of at least a third of an inch, showing that the ligamentum patellæ is not on the stretch normally; and so free is this motion of the bone that the leg can be

¹Read before the New York Surgical Society, January 12, 1887.

flexed on the thigh to an angle of about 130° before the patella becomes fixed and immovable. And I have never been able to satisfy myself that this motion was any freer in my own limb with the body and thigh approximated, as they necessarily are in the sitting position, than in the limb of another person lying on a bed in a horizontal position, although theoretically it ought to be so.

The quadriceps muscle also has insertion into the capsular ligament, as well as into the tubercle of the tibia, through the ligamentum patellæ. A considerable part of the vasti muscles converges, it is true, to be inserted into the patella; but there is, after all, a certain part of the tendinous tissue directly continuous with the thin but strong capsular ligament. A very little dissection will demonstrate this to the eye; and the power to render the ligament tense is shown by traction on the vasti muscles in the dead subject, and a still better evidence of the force exerted by the vasti muscles in extension of the leg in the living subject is manifested by placing a finger on each side of the ligamentum patellæ and making the effort necessary in extending the leg, when the ligament will not only be found to become tense, but will perceptibly broaden under this effort.

This free motion of the patella is as marked, however, when the limb is horizontal as when it is elevated with the idea of approximating the origin and insertion of the muscle. It seems to me that these points are of value in deciding on what measures we shall use in diminishing the amount of separation that exists when the bone is fractured. The production of a few cases of fracture of the patella in the dead subject has thrown some light on the conditions essential for separation to take place in the fragments. I have been struck, in the first place, by the difficulty of producing a fracture of the bone by direct violence even with the leg flexed; and when the bone is sawn partly through from within outward, it is still difficult, by any force applied on its external surface, to complete the solution of continuity. When the partial section is made in the opposite direction, from without inward, a slighter force will complete it. When the bone is fractured alone,

without any injury to the ligamentous and aponeurotic tissues adjacent, the amount of separation of the fragments is practically nothing; the moderately thin handle of an ordinary scalpel in a post-mortem case can with difficulty be inserted flatwise between the fragments. This amount of separation, as we all know, can be increased by cutting the soft tissues at the side of the bone; but, even when the capsule is cut to the extent of three inches laterally on each side from the edge of the patella, the fragments could not be separated more than three inches and a half, and this required some pressure to be made on the lower fragment. Additional separation could be obtained only by further lateral cuts and by vertical incisions upward.

The few attempts that I have made to produce separation of the fragments of fractured patellæ by injections into the joint have been almost entirely failures, whether employing air or fluids, for, in order to allow of the separation taking place at all, the aponeurotic tissues of the joint must necessarily be cut more or less, and, although the nozzle of the syringe can be tied in securely, the air or fluid injected, with even slight pressure, finds its way into the areolar tissue outside of the joint cavity, and distends its meshes very rapidly. It seemed to me, however, that there was a slight separation produced by the fluid that remained in the joint; but of this I cannot be sure. Of course, where the bone is broken in the living subject, and inflammatory changes obliterate, in part at least, the areolar spaces in the immediate neighborhood of the lacerated capsule, and the fluid accumulates slowly, the problem is somewhat different, and, under these circumstances, the fluid might act in a way that it would be impossible for it to do in the dead body. I have an impression also, but nothing more, that, when the limb was elevated, the upper fragment sank a little downward by the weight of the water that remained in the upper part of the synovial sac. I should be unwilling, therefore, to draw any conclusions from my attempts to separate the fragments of broken patellæ by intra-articular injections.

I desire also, in connection with this subject, to describe the post-mortem appearances in two cases of fractured patella

in the Brooklyn Hospital, where death resulted from other causes, but within a few days of the production of the fracture. These appearances are, of course, familiar to all of us, but an ocular demonstration of them adds interest to the matter under discussion, and these are the only opportunities that I have had to examine such cases. I can save time and space by speaking of them together.

They were middle-aged men. The fracture was in the right patella; recent in each (within three or four days of death); one known to have been produced by muscular action, and the other probably so, for the patient was intoxicated at the time of injury, and knew nothing of the method of production, but there were no marks of bruising in the soft parts over the joint except a discoloration near the biceps tendon; the skin was somewhat less movable over the fractured than over the sound patella; there was a separation of the fragments of about an inch and a half; the circumference of the knee was an inch in the first, and an inch and a quarter in the second case, greater than in the other knee; the lower fragment sagged down to a very slight extent. The fracture was a little below the middle of the bone, and transverse, and the edges felt sharp and well defined. On cutting into the joint, a small subcutaneous clot was found in the first case, and a clot as large and as thick as the palm of the hand in the second case, over the biceps tendon. The areolar tissue over the fragments was stained with blood, and, to some extent, matted to the tendinous covering of the upper fragment; the joint had been directly opened into by a rather lacerated wound on each side of the patella, in each case about two inches or two inches and a half in length, and, in addition, in the second case there was a vertical rent, partly through the vastus externus and through the synovial membrane, about three inches in length; there was a moderate amount of bloody serum in each joint, and in the second case there were a few small clots; the upper fragment in the second case was more movable upward than in the first case. Much to my surprise, the fractured edges were not sharp and clean-cut, as I had supposed from my examination before the joint was opened, but the rent in the periosteum in front was at a lower level than in the bone itself, and quite irregularly lacerated, so that it dropped down like an apron in front of the free edge of the upper fragment, partially covering the broken surface. This was true of both cases, and in the first case there were a few particles of bone adherent to the lower side of this periosteal flap. The edges of the

fracture were covered and concealed by a firm clot that required considerable pressure with the thumb-nail to remove it, and this, with the periosteal flap already spoken of, was undoubtedly the explanation of my inability to obtain crepitus, although the fragments could be brought into contact with each other.

I take this peculiarity in the fracture to be unusual, not finding it described; but it is none the less singular that it should have been found in the only cases that I have had an opportunity to examine after death. To consider briefly the conditions that obtain in the living subject, we may start with the statement that the amount of separation of the fragments depends on the amount of laceration of the ligamentous and tendinous tissues in the neighborhood of the patella; not that in every case of extensive laceration there must necessarily be a wide gap, but that in every case of wide separation there must be extensive laceration as an essential condition. The presence of a considerable separation on superficial examination is proof of a considerable laceration, and we can satisfy ourselves of the presence or absence of laceration in cases where the fragments are close together by gentle flexion of the leg on the thigh, when the quadriceps will be excited to contract and tend to draw up the upper fragment, while the lower fragment will be displaced downward in cases where there is any laceration. If there is little or no separation under these circumstances, we may know that there is little or no laceration. I have occasionally, with the same object in view, made gentle pressure upward and downward on the fragments, but it has been accompanied by rather more pain than by flexion.

If we come now to consider the causes of separation of the fragments, while we admit that the clot interferes temporarily with the close approximation of the fragments, and the periosteal flap may in some cases prove a permanent obstacle to bony union, we must recognize that the real causes of separation are either muscular action or fluid accumulation in the joint; and it seems to me that facts do not warrant us in excluding either one of these causes. It does not seem to me that there is any natural tendency for the muscle to draw the upper fragment upward, inasmuch as the bone is so movable in its tendon; but when fracture takes place, the quadriceps is no exception to the contraction that takes place in all voluntary muscles after fracture, produced probably either by direct or reflex irritation—contraction that, unless overcome by proper methods, causes a very considerable amount of permanent shortening. There are also frequent contractions of the muscle taking place whenever the patients attempt to sit

up, or even to turn over or to raise the hips, etc.; for, while the muscle is comparatively inactive after fracture, I do not think that it is paralyzed, for, with slight stimulus, the upper fragment is perceptibly drawn upward by it. Free from any tendency, therefore, to draw the unbroken bone upward, it seems to me, when fracture has taken place, that spasmodic action and the usual contraction that takes place after any fracture are causes at work in the production of the gap in fractured patella. And these two kinds of action take place quite as readily with an elevated as with a horizontal limb. It is true also that in the few cases of separation of the ligamentum patellæ that I have seen the bone has been drawn upward, producing a perceptible depression at the point of rupture, even though the joint was not injured and the amount of fluid in the synovial sac did not seem adequate to account for the displacement.

That the fluid in the joint, however, is a potent element in the production of separation, is to my mind quite clear. I saw it very forcibly illustrated in a case of fracture in the Brooklyn Hospital, while interne in that institution:

An officer, in helping to transfer an injured patient from a carriage to the hospital entrance, slipped and fell, producing a fracture of the patella. I saw him within five minutes of the receipt of the injury and found no separation. The fluid accumulated in the joint, and the separation increased as the fluid increased.

One would expect that if there were tension of the muscle normally present, the separation would have taken place immediately; and it might be said that the usual behavior of muscles after fracture would account for the gap as well as the fluid in the joint; but, as the fluid was absorbed, the gap diminished, as is not infrequent, and this I think could have been due only to the diminished pressure on the fragments by the fluid in the joint. Important, therefore, as the fluid in the sac is as a cause of separation of the fragments in fractured patella, it seems to me a less potent cause than the unusual action of the muscle. For what I saw in a case a few weeks since is generally true in cases that I have observed: that while the fluid had increased the circumference of the knee by two inches beyond the normal measurement, and aspiration had been suggested, by careful and slow traction of the fragments, crepitus could be obtained, although the fragments were quite two inches apart. It must be remembered that the normal capacity of the joint is increased by the rent in the soft tissues and the opening up, to some extent, of the areolar spaces in the neighborhood. Of course, it goes without saying that the inflammatory trouble in the

joint enters as a somewhat important element in the treatment of the fracture.

The indications for treatment are plain enough with regard to the coaptation of the fragments. The other indications usually mentioned are the treatment of the inflammation of the joint and its resulting effusion, and the prevention of ankylosis.

The first is by all means the most important, and the variety of devices used for the purpose shows, in the main, their inefficiency. It seems to me, in the first place, that elevation of the limb is unnecessary and undesirable, for the reasons already given. All those methods for approximating the fragments that make traction on the skin alone and indirectly only on the bone are very inefficient in bringing the edges of the fragments together. They have the advantage of early application, of not pressing downward or tilting the fragments and thus avoiding the formation of adhesions; but being attached only to the movable skin, they must fulfil very imperfectly this first indication.

Those appliances that are used where traction is made obliquely backward and downward and upward on the fragments, while more powerful and efficient than the former method, have some objections. They cannot be applied until the inflammatory trouble subsides and the fluid is in part at least absorbed, or, if applied earlier, they produce so much pain that the necessary force can not be used to approximate the fragments, and while pressing on the fragments they at the same time press on the fluid, and in both ways tilt the fragments up; and even when applied late, they press the fragments against the condyles of the femur and favor the development of adhesions. Nor have they a very good control over the upper fragment, for the least involuntary effort at contraction obliterates the depression above the patella and the bone slides up underneath the dressing, I think the objection made to them by Manning has force also, that the striction of the dressing presses on the nutrient arteries and so interferes with repair. The most efficient way of approximating the fragments and keeping them in contact is by traction directly on the bone, and it seems to me that Malgaigne's hooks accomplish this end satisfactorily. They can be applied very easily; the traction is made directly on the bone fragments, and is in the long axis of the limb, thus avoiding both tilting and adhesions to the condyles of the femur, the fluid in the joint assisting in lifting the fragments up away from the condyles; the control of the motion—or the effects of motion—in the quadriceps is complete; the fluid does not interfere with the application; they therefore give the best chance for bony or very short ligamentous union.

The objections, it seems to me, are not all sufficient to deter us from using them, in view of the advantages they possess. I have used them in five cases with success getting as an immediate result a shorter bond of union than by any other method, though never union by bone thus far. The pain was not great, the location of the introduction of the points not being a specially sensitive part, and the wounds behaving kindly by constant care and cleanliness. The pain of introduction could be diminished by the use of cocaine subcutaneously. The danger of necrosis, of erysipelas, suppuration, etc., is undoubtedly to be taken into account, but must be of very rare occurrence. The objection that if their use is followed by bony union the patient is worse off than if he had a moderately short ligamentous union on account of the greater liability of refracture, it seems to me is not a fair one, for the cases of refracture or rupture under these circumstances seems to have occurred soon after the discharge of the patient, while the bond of union was still weak; and we have all seen the same thing take place in cases where the separation was half an inch or more in extent, the firmness of the ligamentous band being dependent rather on its age than its length. The objection that they are "infernal" and "barbarous" is not sufficiently exact to be answered.

The second indication—the treatment of inflammation and the fluid accumulation—has been fulfilled in my cases by the ordinary rest, evaporating lotions, etc. I never have found it necessary to aspirate the joint, and it must be very seldom necessary to resort to this measure, as the broken fragments can be very easily approximated with the joint quite distended with fluid; besides the operation is not entirely free from the dangers of suppuration in the knee joint. It seems to me unwise to resort to any active measures in fulfilling the third indication, the prevention of ankylosis, by flexion ever so gentle before the eighth week at the earliest; and to do this by the third week, as is recommended, is dangerous to the integrity of the ligamentous union if sufficient force is used to affect the adhesions at all.

I should expect, and have obtained, the best result in the treatment of simple transverse fracture of the patella by applying a posterior splint with the limb horizontal and lying in a natural position but not fully extended, by using Malgaigne's hooks introduced on the first or second day after the receipt of the fracture, by keeping this dressing on for four weeks, then removing the hooks, but not the splint, which has been kept on for four weeks more, the patient being in bed; then the patient allowed to be out of bed with the knee immovable for four weeks longer; by the use of the ordinary remedies for the relief of the

inflammatory joint symptoms in the early stage, but without resort to aspiration; and by avoiding any effort to disturb adhesions until after the end of the third month, and then only by the patient's ordinary use of the joint in walking, etc.

I have purposely omitted saying anything about unusual forms of fracture of the patella, because they are outside the scope of the present inquiry, and have also said nothing of the treatment of old cases with weak knee by wiring, because I have no personal experience to relate.